Rootstock Selections for Improved Salinity Tolerance of Avocado

Continuing Project: Year 6 of 8

Project Leaders: David Crowley (909) 787-3785)
E-mail: crowley@mail.ucr.edu
Dept. of Environmental Sciences
University of California, Riverside, CA 92521

Mary Lu Arpaia (559- 646-6561)
E-mail: mary.arpaia@ucr.edu
Dept. of Botany and Plant Sciences, UC Riverside
Kearney Agricultural Center, 9240 S. Riverbend Ave., Parlier, CA 93648

Cooperating Personnel: Woody Smith, Pete Clark, and Gary Bender

Benefit to the Industry

Avocado trees are frequently grown in areas where the only available irrigation water is highly saline and contains high levels of sodium and chloride. In California, this problem has becoming increasingly common as the cost for high quality irrigation water has increased and growers leach their soil less frequently, or are forced to rely on saline groundwater for their irrigation water supply. This project will provide avocado growers with information on which rootstocks are most useful for production of avocado on saline soils. Identification of rootstocks which can be incorporated into the breeding program will eventually allow growers to use irrigation water having a higher salinity content that is currently used for avocado production. As water costs increase and growers rely increasingly on saline water for irrigation, this will permit use of higher salinity water with lesser damage to the trees and concomitant reductions in crop yield. Research on the interrelationship of tree responses to salinity management through improved irrigation practices is expected to provide fundamental information that will lead to development of integrated management practices that are critical to long term viability of the avocado industry in California.

Objectives

1) To compare the salinity tolerance of currently used and newly developed *Phytophthora* root rot resistant rootstocks in field experiments which will allow us to ascertain the physiological basis of salinity tolerance, and make recommendations for specific rootstocks which can be used by avocado growers in California.

2) Identify new rootstocks which will be incorporated into the ongoing breeding program at UCR for selection of *Phytophthora* resistant, salinity tolerant plant material.

Summary

Experimental Design. A field trial was established in spring 2001 at the Stehly Ranch near Valley View, California in which we compared 15 different rootstocks that were grafted with

Hass scions. Irrigation water used on this field plot is highly saline with an average EC of 2.5. This year, we evaluated the second year's data for these trees, which provided confirmation that there are highly significant differences in the salinity tolerance of the rootstocks that were tested. Continuation of this first field experiment was compromised by a frost during the winter of 2001 which killed many of the trees. However, we are continuing to monitor the remaining trees in this plot during 2003, and two additional field experiments were established this year. In addition we are conducting leaf tissue analyses for Na and Cl on trees from several rootstock trials being conducted under the Phytophthora resistance screening program being conducted by Dr. John Menge where several new rootstocks are being evaluated.

One of the two new field trials that we established this year will compare 10 rootstocks including several new Israeli selections that were not included in the earlier trial (Table 1). This experiment was planted in late June at the Stehly Ranch. The second field experiment will compare the salinity tolerance of 5 different rootstocks at the Pete Miller Orchard in Santa Barbara. In this experiment, the rootstocks are grafted both with Hass scions and with Lamb Hass, which is purported to be more salinity tolerant than Hass.

Table 1. Rootstock selection planted in two new field trials that were established in June and July 2003. All trees at the Stehly Ranch were grafted with Hass. Rootstocks at the Miller Orchard were grafted with both Hass and with Lamb Hass.

Stehly Ranch Site II (Valley View)	Pete Miller (Santa Barbara)
Duke 7	Uzi
Spencer	Dusa
Parida	Zentmeyer
VC 44	Steddom
VC 207 (Day)	Thomas
VC 801	Latas
PP14 Uzi	
PP 16 Rio Frio	
PP 24 Steddom	
VC 218	

Field Trial Results for Year Two (Stehly Ranch, Experiment I)

Results of the leaf tissue analyses for chloride and sodium for 2002 are provided in Figures 1 and 2. The three best rootstocks for preventing chloride accumulation in the scion are Latas, Evstro, and VC801. Low levels of chloride were also observed for scions grafted on to VC 218 and Toro Canyon. The worst performing rootstocks with respect to chloride accumulation were Barr Duke, Duke 7, Zutano, Thomas, PP4 and PP5. Levels of chloride accumulation were higher than in 2001, which is probably due to the dryer year, but the relative differences between the different rootstocks was nearly identical for both years.

The sodium accumulation patterns for the different rootstocks also were very similar in the second year as compared to the first year's data (Figure 2). Trees grafted on to VC 241 had the

lowest Na concentrations, followed by Latas, Duke 7, VC 256, and Evstro, which had less than 0.005% Na. Following this group, PP5, Thomas, VC 218 and Zutano had intermediate levels ranging between 0.05 and 0.08% Na. The worst rootstocks were Barr Duke and PP4, which had foliar Na contents of 0.015%, or more than 7 times more than the best rootstocks.

There were also considerable differences in the tree vigor as determined by measurements of the canopy volume (Figure 3). Statistical analysis of the differences between the rootstocks revealed two different groups. The best performing rootstocks with respect to growth were Duke 7, Evstro, Latas, VC 256, and VC 801. The rootstocks which resulted in poor growth were PP3, PP5, Thomas, Toro Canyon, VC 218 and Zutano.

Conclusions

There is significant variation among the performances of the different rootstocks that have been tested to date, with respect to tree growth, vigor, and development of leaf burn symptoms that are associated with salinity damage.

Three rootstocks, Latas, Evstro, and VC 801 are superior in salinity tolerance, and accumulated low quantities of chloride and sodium in the Hass scions.

Two new field experiments will be evaluated in the coming year, and an additional field experiment will be initiated to compare a new set of rootstocks in May 2003.

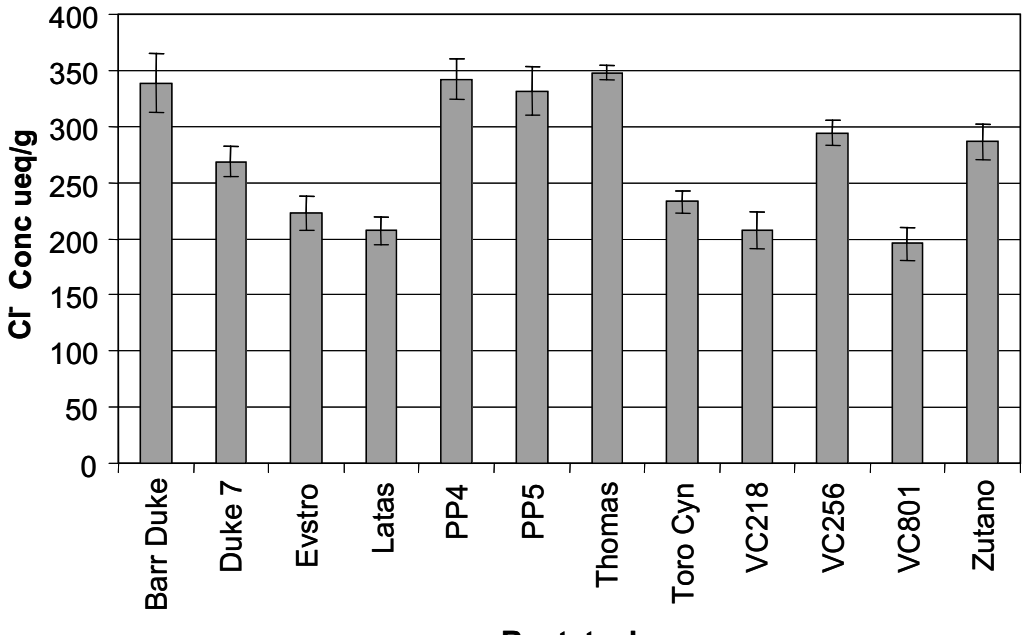

Figure 1. Chloride content of leaf samples from Hass scions grafted on to different rootstocks for leaves collected Sept 24, 2002.

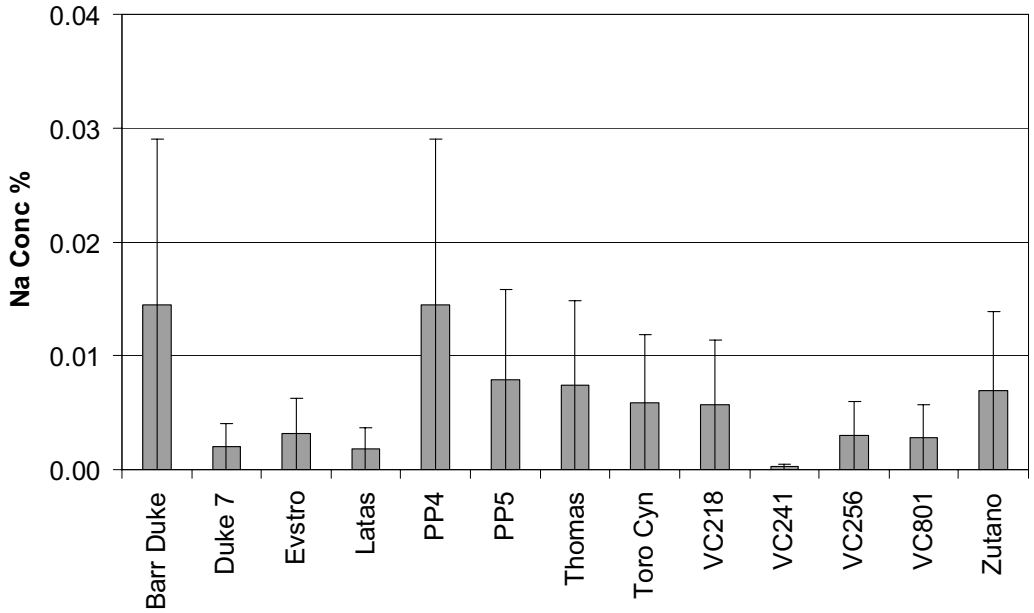

Figure 2. Leaf sodium concentrations for leaves from Hass scions grafted on to different rootstocks that were screened in the Stehly Ranch Salinity Trial I in Sept. 2002.

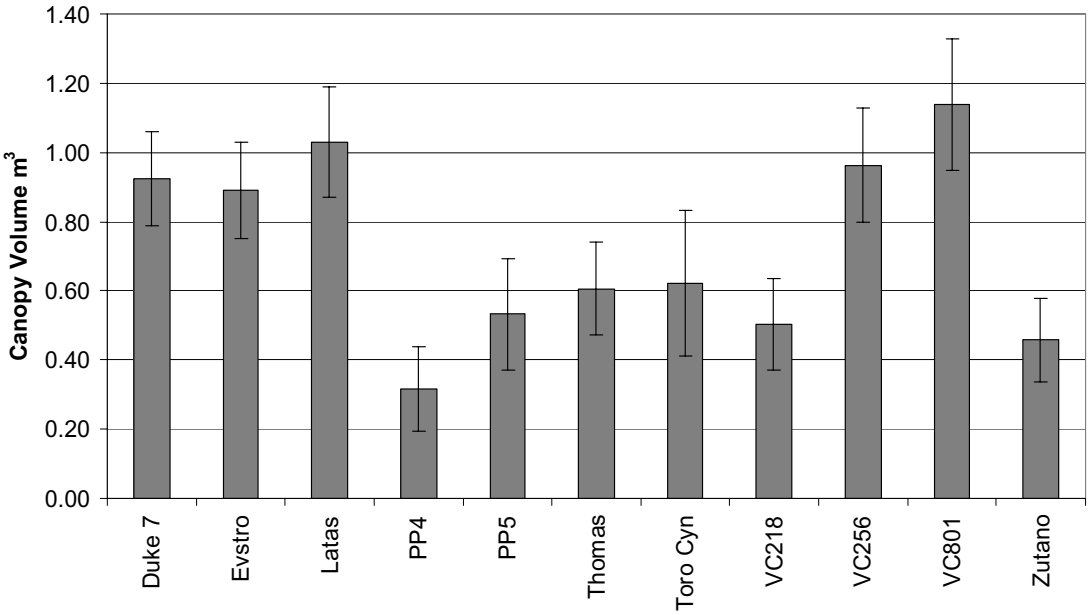

Figure 3. Differences in tree canopy volume in September 2002 for Hass avocado scions grafted on to rootstocks differing in salinity tolerance. Vertical bars are standard errors of the mean.